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PROPOSES METHOD FOR EXPEDITING SHIPMENT OF BULK GOODS IN THE GDR

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Railroad students at the Dresden Institute of Technology are at present investigating the possibilities of the following suggestions which have been submitted by the author.

During the periods of maximum traffic, railroads always experience traffic problems, because loading, unloading, and transshipment in the railroad yards always require a great deal of time, and the railroad-yard facilities are often inadequate for the handling of large-scale unloading operations.

Container traffic is not a new phenomenon for the railroads. It was introduced and further developed in Germany to provide the shippers with a better loading medium, to reduce the problem of packing, to cut costs, and to bring goods directly to the receiver's business in the same manner as with road vehicles. Large-volume containers, on the other hand, were little utilized in Germany.

Container cars have been in use, particularly for the wholesale coal business. These containers, which are placed on undercarriages, are hoisted and dumped by means of cranes. In this way, the transshipment was less wasteful, but not measurably cheaper, because the cost and the savings tended to equalize each other. Railroad transportation of bulk goods in large-volume, roadable containers (Grossraumbehaelter-Strassenfahrzeuge) will largely eliminate the manual labor involved, will increase the handling capacity, and will reduce costs.

The quality and quantity of all bulk goods decreases with each reloading, and the greater the number of transfers, the greater the losses. Thus, it is no wonder that households are delivered crushed briquettes and brused potatoes for their winter supplies. The sole blame for this loss in quality can be laid to

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the poor transportation methods utilized in the handling of these items; we must, therefore, build railroad cars which, coupled with roadable loading-space, will make possible the uninterrupted transportation of all bulk goods from the producer to the consumer in the shortest possible time.

Let us consider the transportation of domestic fuel from the briquette factory to the railroad station where it is unloaded, thence to the bins of the coal dealer, and from there, by vehicle, to the consumer. Already at the railroad stations, the briquettes are simply thrown on the team yard driveway, because the cars must be unloaded quickly, and because not enough delivery vehicles are available at the time.

One can witness daily the wasteful transshipping of bulk products in the railroad yards and on the streets. Much time, labor, and valuable raw materials are lost. If we take into account every penny, every gram, and every minute, then the present wasteful transportation of fuel can no longer be defended from an economic standpoint. Therefore, the elimination of this situation becomes an urgent necessity.

The suggested use of large-volume roadable containers will work as follows:

The containers are placed on a flat car with wooden side racks, in a position athwart the car's longitudinal axis. The containers have self-emptying saddle bottoms, and each section has a capacity of 2.5 tons of material. Since almost every railroad station has a side ramp, the containers can be pulled off the car and replaced immediately with the waiting empties. The containers can be motor drawn or horse drawn through the streets to the consumer. The farmer, too, can thus unload commercial fertilizer or load potatoes right at the edge of his field. Macadam can be brought directly to the construction site, and in case of rubble removal or major earth work during the course of building our new production sites, the self-emptying feature of these containers will come in handy. They may also be utilized, within limits, as replacements for Talbot cars or for hauling coal to the railroad shops.

Quite naturally, the majority of railroad-car designers object to loading one vehicle on another. Modern engineers, they say, reduce the dead weight of the car and do not load car on car. This is true only up to a certain point and depends entirely on the result of the work performed. If the result is favorable, why not proceed thus?

For illustration, let us assume that 150,000 tons of bulk goods are to be shipped daily and that the average shipping distance is 300 kilometers.

What will be the change in the ratio between the dead weight and the weight of the loaded car?

Present Cars

Item	Tons
Dead weight	10
Load capacity	15
Total weight	25

Ratio of dead weight to load: 10 tons:15 tons, or a dead weight of 40 percent of the total.

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Planned Cars With Containers

Item	Tons
Dead weight	15.0
Four containers, 1.7 tons each	6.8
Load capacity	20.0
Total weight	41.8

Ratio of dead weight to load: 21.8 tons:20 tons, or a dead weight of 52 percent of the total.

The car designers are right; the ratio of dead weight to total weight has increased by 12 percent. Such cars should really not be built.

How much of an increase in fuel consumption will be required as a result of the increase in dead weight?

Present Haulage

(10,000 cars daily equals 167 trains at 60 cars each)

Item	Tons
Train weight: 60 cars x 25 tons	1,500
Weight of locomotive	120
Total	1,620

1,620 tons x 300 kilometers x 167 trains equals 81.2 million ton-kilometers.

Fuel consumption: 81.2 million ton-kilometers x 40 tons of fuel per million ton-kilometers equals 3,248 tons of fuel.

150,000 tons of freight carried daily require 21.7 kilograms of fuel per ton (one ton of freight equals $\frac{\text{3,248,000 kilograms of fuel}}{\text{150,000 tons of freight}}$)

Planned Haulage

(7,500 cars daily equals 150 trains)

Item	Tons
Train weight (50 cars x 41.8 tons) equals	2,090
Locomotive weight	120
Total	2,210

2,210 tons x 300 kilometers (average hauling distance) x 150 trains equals 99.5 million ton-kilometers.

Fuel consumption: 99.5 million ton-kilometers x 36 tons of fuel per million ton-kilometers equals 3,582 tons of fuel. (Because the train weight has increased from 1,500 tons to 2,090 tons (about 40 percent) and all the trains thus come within the heavy-train category, the specific coal consumption per million ton-kilometers has been reduced by 10 percent.)

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150,000 tons of freight hauled daily require 23.9 tons of fuel per ton, as shown below:

$$\text{One ton of freight equals } \frac{3,582,000 \text{ kilograms of fuel}}{150,000 \text{ tons of freight}}$$

That is an 11-percent increase in fuel consumption per ton of freight.

Here, too, the car designers are right, for the 12-percent dead-weight increase per car requires an increased coal consumption of 11 percent, or 2.1 kilograms per ton of freight.

How many railroad cars will be required to transport 150,000 tons of bulk goods daily?

Present Haulage

1. 150,000 tons of freight require 10,000 cars of tons' capacity each.

2. Turnaround time per car is 3.5 days. 3.5 days x 10,000 cars equals 35,000 cars operating.

3. 35,000 cars x 10 tons dead weight equals 350,000 tons of vehicle equipment.

Planned Haulage

1. 150,000 tons of freight require 7,500 cars of 20 tons capacity per car.

2. Turnaround time per car is 2.25 days. 2.25 days x 7,500 cars equals 16,875 cars operating.

3. 16,875 cars x 15 tons dead weight equals 253,125 tons of vehicle equipment.

16,875 cars x 8 containers equals 135,000 containers plus a 5 percent reserve equals 141,750 containers x 1.7 tons equals 240,975 tons of container equipment.

The total for vehicles and containers is 494,095 tons of transportation equipment.

The necessary rolling stock, including large-volume roadable containers, requires 144,095 tons more of transportation equipment. This is an increase of 41 percent.

Because the introduction of large-volume roadable containers will make it possible to dispense with the majority of the ordinary vehicles, the following savings will be effected:

We will assume that out of 150,000 tons of freight, 70 percent or 105,000 tons, are hauled by means of trucks or horse teams. Each vehicle hauls an average of 10 tons daily.

105,000 tons of freight requires 10,500 road vehicles. Dead weight per vehicle is 4.0 tons or 42,000 tons for 10,500 vehicles.

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As shown above, the total tonnage of transportation equipment proposed (cars and containers) is 494,095 tons. This obviates road vehicles of 42,000 tons and 350,000 tons of car weight used with the present method. It thus leaves an excess of 102,095 tons of transportation equipment, as compared with the present method, an increase of 29 percent. In this respect, too, the car designers are right.

How much will the daily savings be in trains and locomotives?

<u>Present Haulage</u>

150,000 tons require 167 trains with 167 locomotives.

<u>Planned Haulage</u>

150,000 tons require 150 trains with 150 locomotives, or a saving of 17 locomotives and 17 trains per day, each with an average run of 300 kilometers. An additional saving can be achieved at this point by making up trains of 60 cars each. There will then be required:

$$\frac{150{,}000 \text{ tons}}{20 \text{ tons} \times 60 \text{ cars}} \text{ equals } 125 \text{ trains}$$

By carrying on only the heavy-freight type of haulage and by loading the trains with 2,508 tons each, a daily saving of 42 trains with a gross weight of 1,500 tons each and 42 locomotives can be achieved.

At this point the objections of the car designers are losing their validity.

What will it cost to transship 150,000 of freight?

The transshipment costs of a ton of bulk goods, from the railroad station by way of the middlemen to the consumer, now average 5.00 Deutsche marks. It is assumed that 70 percent of the bulk goods, 105,000 tons, are transshipped, i.e., 525,000 Deutsche marks in transshipment costs.

When large-volume, roadable, self-emptying containers are utilized, the transshipment costs will be only 2.00 Deutsche marks because the transshipment at the railroad stations will be eliminated, creating only 210,000 Deutsche marks in transshipment costs or a daily saving of 315,000 Deutsche marks.

By now, the car designers must begin to calculate in earnest if they still want to maintain their objections.

Is any labor being saved by the new method?

As mentioned before, it is assumed that 70 percent of the bulk goods are transshipped manually.

Transshipping of 105,000 tons of freight requires 8,750 men on the basis of 12 tons per man. This labor, which is urgently needed for other productive activity, is freed under the proposed method.

How many tons daily can one railroad car haul?

<u>Present Type</u>

15 tons of freight x .75 (25 percent empty return run) with 3.5 days turnaround time equals 3.5 tons of freight daily.

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Planned Type

20 tons of freight x .50 (assuming that all cars are empty on the return run) with 2.25 days turnaround time equals 4.4 tons of freight daily.

The increase in loading amounts to .9 ton per car, or 26 percent. The car designers cannot ignore this increase in efficiency and decrease in net cost. A concession in favor of the present type cars was made by calculating only a 25 percent empty return run, whereas in the case of the planned type, the entire trip was considered to be empty.

What investments in vehicles are necessary, and how high are the maintenance and depreciation costs?

Present Type

35,000 cars at 15,000 Deutsche marks each equals 525 million Deutsche marks. Five percent of this amount will go for maintenance and replacement: 26.3 million Deutsche marks.

Planned Type

1. 16,875 cars at 22,000 Deutsche marks equals 371.3 million Deutsche marks. Ten percent of this will go for maintenance and replacement: 18.6 million Deutsche marks.

2. 141,750 containers at 3,500 Deutsche marks each equals 494 million Deutsche marks. Ten percent of this will go for maintenance and replacement: 49.6 million Deutsche marks.

Comparison (in million Deutsche marks)

Item	Present Type	Planned Type	Increase
Inventory value	525.0	867.0	342.0 (65 percent)
Maintenance and replacement	26.3	68.2	41.9 (159 percent)

The great increase in investment and the maintenance and replacement costs again vindicate the stand of the car designers. But here, too, the computation was made in favor of the present type. Let us strike the balance (in million Deutsche marks):

Item	Present Type		Planned Type	
	Income	Expenses	Income	Expenses
Revenue from 150,000 tons of bulk freight with an average hauling distance of 300 kilometers at 21 Deutsche marks per ton-day	1,150		1,150	
Expenditures for maintenance and replacement of the necessary rolling stock		26.3		68.2

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Item	Present Type		Planned Type	
	Income	Expenses	Income	Expenses
Increase in fuel consumption per ton of freight, as a result of increased dead weight per car				1.9
Savings of 17 trains weighing 2,110 gross tons each times 300 kilometers hauling distance equals 10.8 million ton-kilometers. Cost per one million ton-kilometers assumed with 10,000 Deutsche marks equals 108,000 Deutsche marks daily. Annual savings of			39.4	
Savings through the reduction in transshipment costs from 5 Deutsche marks to 2 Deutsche marks per ton: 3 Deutsche marks daily, or annual savings of			11[illegible]	
Income less expenses listed	1,150	1.123.7 1,150	1,304.4	1,234.3 1,304.4

Resultant savings are 110.6 million Deutsche marks annually.

The increased investments of 342 million Deutsche marks will be made up in 3 years through the reduction in net costs.

No pretense is made that the foregoing calculations are infallible from either a technical, transportational, or mathematical standpoint. Mistakes, shortages, and weaknesses accompany every innovation, but even these crude mathematical computations must have proved that this innovation offers great economic advantages. It is very likely that the results will be far more significant than originally believed.

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